

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1-31. (Cancelled)

Claim 32 (New) A method for producing a filter element that includes the following successive steps:

- 1) application of a membrane layer to a carrier substrate,
- 2) etching a membrane chamber on the side of the carrier substrate opposite to the membrane layer, so that a residual layer of the carrier substrate still remains,
- 3) generation of pores in the membrane layer by means of a lithographic and etching process in order to create a perforated membrane,
- 4) removal of the residual layer of the membrane chamber by etching in order to expose the membrane layer of the membrane chamber, and
- 5) subjecting the membrane to an additional treatment in order to increase its mechanical strength, which additional treatment consists of one or more the following:
 - 5.1) formation of crystal nuclei in the membrane layer in step 1,
 - 5.2) heating temperature treatment of a structure of carrier layer and membrane layer in order to increase the crystalline fraction in the membrane layer in step 1 and/or after step 4,
 - 5.3) isostatic hot pressing of the structure of carrier layer and membrane layer to increase the crystalline fraction in the membrane layer prior to step 3 or after step 4, and
 - 5.4) generation of an internal prestress in the membrane layer in step 1 or after step 4.

Claim 33. (New) A method as in Claim 1, wherein the treated membrane layer has a crystalline fraction of at least 25%.

Claim 34. (New) A method as in Claim 1, wherein the membrane layer is applied to the carrier substrate by means of a chemical vapor deposition process (CVD process).

Claim 35. (New) A method as in Claim 1, wherein the membrane layer is applied to the carrier substrate by means of a physical vapor deposition process (PVD process).

Claim 36. (New) A method as in Claim 1, wherein the membrane layer consists of a ceramic material.

Claim 37. (New) A method as in Claim 5, wherein the membrane layer consists of a non-oxide ceramic.

Claim 38. (New) A method as in Claim 6, wherein the membrane layer consists of a nitride non-oxide ceramic.

Claim 39. (New) A method as in Claim 7, wherein the membrane layer consists of Si_3N_4 .

Claim 40. (New) A method as in Claim 6, wherein the membrane layer consists of a carbide non-oxide ceramic.

Claim 41. (New) A method as in Claim 9, wherein the membrane layer consists of SiC .

Claim 42. (New) A method as in Claim 1, wherein the heating temperature treatment is performed and is performed by holding

the membrane layer in a temperature range of about 200°C to 2000°C at a process pressure of about 5 Pa - 100 Pa.

Claim 43. (New) A method as in Claim 1, wherein the heating temperature treatment step is performed and is performed and is a sintering at temperatures over about 900°C.

Claim 44. (New) A method as in Claim 1, wherein the temperature treatment is performed and is carried out by means of electromagnetic radiation in the radiowave or microwave range.

Claim 45. (New) A method as in Claim 13, wherein the microwave radiation lies in the frequency range above 25 GHz, preferably in a frequency range at which the material of the membrane layer has a peak in its absorption curve.

Claim 46. (New) A method as in Claim 1, wherein the isostatic hot pressing is performed and is carried out at temperatures above about 750°C and pressures above about 100 bar.

Claim 47. (New) A method as in Claim 1, wherein the isostatic hot pressing step performed and is carried out prior to step 3.

Claim 48. (New) A method as in Claim 1, wherein the membrane layer is protected against etching agents after step 3.

Claim 49. (New) A method as in Claim 17, wherein the membrane is protected by a solid masking.

Claim 50. (New) A method as in Claim 17, wherein the membrane layer is protected by a coating material that is again removed after step 4.

Claim 51. (New) A filter element with a membrane layer and a carrier layer, where the membrane layer has a plurality of perforations, wherein in the carrier layer a membrane chamber is exposed, the membrane layer spans over the membrane chamber, and the membrane layer has a compacted and/or at least partially crystalline structure with strength that has been increased over that of the starting material.

Claim 52. (New) A filter element as in Claim 20, wherein the increased strength of the membrane layer is produced through an internal mechanical prestress.

Claim 53. (New) A filter element as in Claim 20, wherein the membrane layer has microcrystalline and/or nanocrystalline structures and/or has been compacted.

Claim 54. (New) A filter element as in Claim 20, wherein the carrier substrate has a plurality of membrane chambers, each of which is spanned over by one and the same membrane layer.

Claim 55. (New) A filter element as in Claim 20, wherein the membrane chamber is rectangular in plan view.

Claim 56. (New) A filter element as in Claim 24, wherein the membrane chamber in plan view has the shape of a slot, whose length is at least twice its width.

Claim 57. (New) A filter element as in Claim 20, wherein two oppositely lying sides of the membrane chamber run at an angle of less than 90° to the plane of the membrane.

Claim 58. (New) A filter element as in Claim 20, wherein the pore ratio of the thickness D of the membrane and pore diameter P have the following relationship: $0.01 < D/P < 100$, where the following applies for the thickness D of the membrane: $0.01 \mu\text{m} < D < 100 \mu\text{m}$.

Claim 59. (New) A filter element as in Claim 20, wherein the pores are essentially circular in shape and have a diameter in the range between $0.01 \mu\text{m}$ and $100 \mu\text{m}$.

Claim 60. (New) A filter element as in Claim 20, wherein the membrane layer, on a side turned toward the membrane chamber, lies on at least one intermediate support, the thickness of which is less than the thickness of the carrier substrate.

Claim 61. (New) A filter element as in Claim 20, wherein the membrane chamber essentially extends over the entire area of the filter element.

Claim 62. (New) A filter element as in Claim 20, wherein the carrier substrate is made from a material selected from the group consisting of Si, SiC, titanium oxides and other titanium compounds, magnesium oxide, zirconium oxide, nickel, chromium, Ni-chromium compounds, Al_2O_3 , yttrium compounds, and that the membrane layer consists of Si_3N_4 , SiC, a combination of the two substances or another silicon ceramic.